AMERICAN JOURNAL OF OPTOMETRY

VOL. 10 JULY, 1933 No. 7

A STUDY OF THE BIO-PHYSICS IN THE FORMATION OF THE EYE-BALL AND ITS CONTENTS*

Nathan Levin, Opt.D.
Chelsea, Mass.

Introduction.

Physiologists maintain that every form of the physical forces are found in the human body: Hydraulics, thermostatics, hydrostatics, gravity, pressure, tension, resistance, elasticity, friction, the screw, the lever, the pump, the pulley. Every structure is engaged in some form of mechanical action, either active or passive.

In the study of the bio-physics, the many systems of the human body are reduced to a condition of equilibrium between the chemical and the physical forces, or, as the conversion of chemical affinity into mechanical action: The mechanical actions are determined by the physical properties of the structures which are an expression of the chemical affinities.

The formation of the structures are thus determined by the physical properties and the magnitude and direction of the mechanical action, by the physical forces. They admit no speculative theories.

In this paper we will attempt to unravel one of the ocular mysteries; the mechanism of accommodation, which, according to the writer's conception, is performed by an invisible force called *hydrodynamics*. We will show the role this agency plays in the shaping of the eye-ball.

This subject is fathomless. Biophysics should be treated in connection with organic chemistry, much of which is unknown. However, we will confine our treatment, from a mechanical viewpoint according to the laws of physics, to the following subjects:

The Potency of the Hydrostatic Forces.

The Mechanism of Accommodation.

The Function of the Radiating Fibers.

Which of Nerve Fibers are Involved in the Act of Accommodation? Somatic or Sympathetic?

The Contracted and Distended Eye-ball.

The Influence of the Tension of the Extrinsics on the Formation of the Eye-ball.

*Submitted for publication February 2, 1933.

The Formation of the Fovea.

The Formation of the Cornea and Corneal Astigmatism.

In the presentation the writer has used his favorite method, by collecting all the evidence and piercing it together, in order to obtain some form of a picture of the whole.

The Potency of the Hydrostatic Forces.

For a clear conception of the hydrostatic forces, we must refer to the principles and physical laws which govern the same. All matter is porous. The spaces between the molecules are a condition of equilibrium between *the attractive and repulsive forces.* Attraction is the inherent property of the molecule, repulsion is by the external agent of heat.

This equilibrium can be disturbed by mechanical compression, and the reaction is repulsion. The hydrostatic force against any area within the chamber, is determined by a common equation. Let F represent the force at the contact with the lens, and F′ the force at the piston, and let S represent the surface area of the lens, and S′ the area of the piston, then:

$$F : F' : : S : S'$$

Let us say that the diameter of the lens is 10 mm., which gives an area of 314.16, and let us say that the area at the piston is 1/1000 of a mm., then the ratio, between the force at the piston and the force on the lens, will be as 1 is to 314160. A child can operate a hydrostatic press delivering tons of pressure: A tiny circular ring of muscles, with an insignificant expenditures of energy, is controlling the shaping of the lens by hydrostatic pressure.

It should be noted, that the term piston, or all the mechanical terms used here, are for the sake of elucidation. Since, *all components express a resultant and every direct force may be decomposed into components,* the actual performance of the secretion is of no moment. Whatever form the secretory method may be, the components must express a resultant, which is the same as if the humor is compressed by a piston with a flat surface.

The other physical laws, which have a bearing on our subject, are as follows: *Liquids transmit equally in all directions a pressure exerted at any point of their mass.*

The line indicating the direction of the pressure exerted by any liquid particle against the surface with which it is in contact, is always perpendicular to this surface at the point of contact. If the surface is a plane, the line is perpendicular to this plane; if the surface is curved, the line is normal to this curve.

Action and reaction are always equal and opposite.

We will repeat, by applying these laws directly to our problem: According to the first law, which defines the *magnitude* of the force, the rise in the potential is in proportion with the difference in the areas between the lens and the piston, as explained before.

The second law defines the *uniformity* or the equality of the force: Whatever pressure there may exist in the aqueous and vitreous humor, the

force is uniform at every point of contact, with the anterior and posterior surfaces of the lens.

The third law defines the *direction* of the force: Whatever curvature there may be present in the surfaces of the lens, the direction of the pressure, by the aqueous and vitreous, is in line with the normal of the curve, at the point of contact. This is equally true of the internal pressure within the capsule of the lens; the direction of the pressure is always in line with the normal of the curve.

The fourth law applies to a condition where two liquids of unequal viscosity, are separated by a septum: The pressure created by the aqueous is, equally and opposite reacted by the elastic force of the vitreous, and the pressure by the vitreous is reacted by the aqueous. The expressed resultant is a uniform pressure on all sides of the lens.

Osmose is a term, which is used in chemical physics, and it means this: When two different liquids are separated by a porous septum, a current is created in the liquid. The flow of the liquid through the septum is termed osmose, and the power which produces it, osmotic force. Under favorable conditions, the osmotic force is of great intensity, and is said that it plays a very prominent role in the secretory processes of the organism.

As the coloration of the blood would interrupt the passage of light, it becomes necessary that the media of the eye should be nourished with colorless lymph. The aqueous lymph is derived from the glands of the ciliary body and iris. A portion of the vitreous is derived from the ciliary, meeting with another stream which comes from the glands of the choroid. The zonule of Zinn is the probable septum, which creates the osmotic force, producing a system of currents in the lymphatic bodies.

The osmotic process is from the aqueous to the vitreous. Some streams have their course to the optic disk, and find their way into the hayloid canal. Others, of greater intensity, are reflected backwards into the aqueous chambers, and connect with the veins in the canal of Schlemm and Fontana spaces.

Osmotic force has been defined as "the conversion of chemical affinity into mechanical effect." The action is somewhat like a galvanic battery; the chemical action of the liquid on the septum is different on its two surfaces. It is a force of great intensity, capable of supporting a column of water several meters high.

The Mechanism of Accommodation.

Hydrostatics expresses the static refraction of the lens, hydrodynamics the dynamic refraction of the lens. When forces are in equilibrium it is termed static, when in motion, dynamic.

Three components are involved in the shaping of the lens. (1) The external pressure, by the aqueous and vitreous humor, on the lens. (2) The internal pressure within the capsule of the lens. (3) The tension of the ligaments.

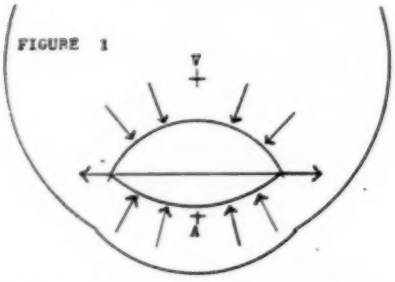

Figure 1 explains the direction of the forces involved. The lines of direction of the pressure, in the aqueous, are shown to be converging to point V, which is the center of curvature of the anterior surface of the lens. The lines of direction of the pressure, in the vitreous, are shown to be converging to A, which is the center of curvature of the posterior surface of the lens.

The elastic force of the lens radiates, from the center, in all directions and, as stated before, in all hydropressure, the direction is in line with the normal of the curve.

The viscosity of the lens, or the cohesive resistance to change its form, is greater at the center, gradually diminishing towards the periphery. The lens is thus sandwiched in between the aqueous and vitreous and pressed into shape of a biconvex lens.

With no internal pressure, the lens would be shaped flat, by the external pressure and tension of the ligaments. With no tension by the ligaments, the external and internal pressure, would shape the lens globular. With no external pressure, the lens would be shaped elliptically.

Since the direction of the force of the internal lens pressure is in line with the normal, the interference of another component, the tension of the ligaments, would express a resultant other than the normal. This is true at every point of contact, presenting an impossible condition for a perfect spherical curve. On the other hand, the two components, the external and internal pressure, have a common resultant from every point of contact, thereby minimizing the interference of the tension of the ligaments.

In other words, the tension of the ligaments tends to disturb the perfection of the sphericity of the lens, while the tendency of the internal and external pressure is for a perfect spherical curve. (We refer to muscular force, as tension, to hydro force, as pressure to distinguish between the two.)

Again, the influence of the tension of the ligaments is inversely proportional to the cohesive resistance of the lens, to change its form: greater at the equator, gradually diminishing towards the pole. The slight elliptical effect, which may be present at the periphery of the lens, is advantageous in neutralizing the spherical aberration.

The investigations of Young and Tscherning showed that the amplitude of accommodation is greater at the center of the lens than at its periphery.

FIGURE 2

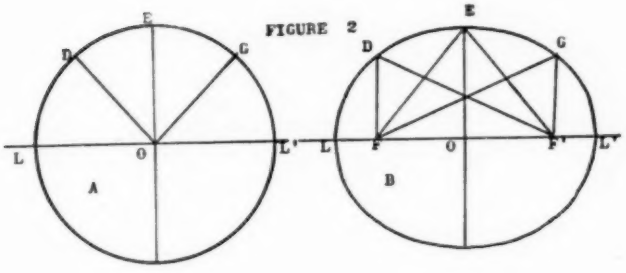

Figure 2 explains, in a simple manner, the elliptical effect by the tension of the ligaments. A shows the direction of the pressure at points L, D, E, G, L′. With no tension, the radii meet at a common point 0. In B the same characters denote the same points of contact. The tension of the ligaments is independent and is directed against the center 0. Its influence is to split 0 into double foci; F. F′. The line L, F, O, F′, L′ represents the resultant of the tension and pressure in this direction. The sum of the two radii, F, D and F′D or F E and F′E or F G and F′G is equal to the line L L′. The two radii are in conjugate at any point of contact, and describe the ellipse L D E G L′.

It should be noted that the attachment of the ligament is not on a plane with the equator of the lens, but it is anteriorly. Thereby exposing, posteriorly, the greater half of the lens to the influence of hydropressure. For this reason we find that the posterior surface has a sharper curve than the anterior. Had the attachment been on a plane with the equator, dividing the lens into two equal parts, the anterior and posterior surfaces would have the same curvature. But, as the attachment is on a plane which divides the lens into two unequal parts, the curvature on the two surfaces must of necessity be unequal.

We may ask, is there any special advantage in having a sharper curve on the posterior surface? Our answer is, no. It seems that a greater economy of energy would be effected if the act of accommodation would involve a greater increase in the curvature of the anterior instead of the posterior: The increase in the refractive power of the lens would be favored in effectivity by the increase in the distance between the lens and retina.

Embryologically, we find the lens as the most primitive in origin. It fills the whole cup of the eye, with a small margin at the base for the crescent shape vitreous. In the next stage, the cornea is formed as a part of the anterior surface of the lens. This is followed by another stage where the aqueous is formed, separating the cornea from the lens.

The point we are aiming to show is, that from the very incipiency of the embryo to the adult life, the vitreous is constantly engaged in pushing the lens outwardly. It has accomplished a great deal, but it is still short from its mark. Every stage is transitory, and the stage we find today is not, as yet, the acme of perfection.

In the light presented here, the mechanical action of the accommodation, and the anomalies of the refraction of the lens, becomes very much simplified. The contraction of the circular fibers, intensifies the pressure, releases the tension of the ligaments, which slack is instantaneously taken up by the hydrodynamic forces, by shortening the diameter of the lens.

It is obvious that if a slack or a tension be greater in one meridian, a sphero-cylinder curvature must of necessity be expressed on the surfaces of the lens. Such mechanical effects are possible, only, through hydrostatic pressure.

The Function of the Radiating Fibers.

Nothing definitely is known about the function of the radiating fibers in the ciliary body. Nevertheless, we will venture to say the following: According to the description given in text-books, the radiating fibers are much more numerous than the circular. This dispels the thought that the radiating fibers are the antagonists and the circular are the agonists. As it is very difficult to explain how the negative action becomes more developed than the positive.

The circular fibers are more developed in hyperopia than in emmetropia, and are underdeveloped, or absent, in myopia. But the radiating fibers are always present. This shows that the circular fibers are directly involved in the act of accommodation, and the presence of the radiating fibers, in myopia, indicates that they have a different function.

The radiating fibers extend from the sclera-corneal junction to the choroid, some pierce the choroid and are connected to the sclerotic. We must bear in mind that *the direction of the fiber denotes the direction of its force.*

From the direction of the force of the radiating fibers, and from many other evidences, which will be pointed out later, we are inclined to reason that they are the remnants of the bygone stages. It will be shown that the tension of the radiating fibers plays an important role in the developing and shaping of the cornea. In the act of accommodation they act as a brace to reinforce the choroid and sclerotic with the edge of the cornea, to withstand the hydropressure.

The viscosity in the vitreous is greater than in the aqueous, which acts as a buffer, to some extent, against the pressure. Otherwise the whole force would expend itself against the walls of the eye-ball. The aqueous humor is very much like water, and is ideally adapted for instantaneous reaction under pressure, and it becomes necessary to protect the walls of the anterior chambers with a muscular tension.

Which of the Nerve Fibers Are Involved in Act of Accommodation? Somatic or Sympathetic?

A brief review of this problem in general will not be amiss. All the double organs of the human body, such as the brain, the eyes, the ears, the limbs, have been grouped into one class called *the animal.* All the single organs, such as the heart, the lungs, the stomach, the apparatus for

reproduction, have been grouped into another class, and known by the following terms: *The vegetative, the viscera, the autonomic, the sympathetic, the ganglionic.* The two lungs are asymmetrical, and are classed as one organ. One side of the brain is symmetrical with the other side of the brain, and are classed as two brains.

These terms express the general characteristics of the groups. The single organs are concerned with respiration, digestion, assimilation and reproduction, which are identical with the functions of the plant, hence the term *vegetative.* The animal group are concerned with sensory-motor, special lenses, will power and thought, and are generally referred to as *somatic.*

The vegetative group are inclosed within, and protected by, the walls of the body. Hence the term *viscera,* meaning the organs within the great cavity.

The animal organs must have periodic sleep and rest, for recuperation, the viscera is constantly awake and active, independent of the somatic sleep. The vegetative organs express the most vital, or primary functions of life, and its nervous system takes priority in the evolutionary processes.

From a diffused state with the other tissues, by differentiation, the nervous tissues have segregated into a distinct system. But the form of distribution has been retained, in order to promote cooperation and coordination between the vital organs. For this reason it is called *autonomic,* also *sympathetic.*

The sympathetic and the somatic are of different characteristics, so all connections between the two systems are made by ganglia. In terms of electrical energy, the action of a ganglia is, somewhat, a combination of a generator, condenser and transformer: In passing from one system to the other, the energy is attuned or transmuted, by the ganglia, to like properties, hence, the term *ganglionic.*

Para-sympathetic is, as the term signifies, a twin system to the sympathetic; to assist and reciprocate the sympathetic, in the heavy duties.

The function of the sympathetic system is twofold: to connect the vegetative under an independent control and to connect the vital organs with the other organs, thus establishing a *sympathetic union* of the whole body.

To what extent the sympathetic system is involved in the eye, has been a subject of much speculation between the different writers. It is known that a disturbance in the digestive system affects the eyes, and an eye strain may affect the digestion. No one denies that the eye is in some form connected with the vegetative.

Maddox' conception is that the motor reflexes, of the eye, are linked with the vegetative. He includes the motors, which create the binocular, but not which direct the binocular.

Dr. Wiseman's conception is that the radiating fibers of the pupils and ciliary are energized by the sympathetic, and the circular fibers of

the sphyncter and ciliary, by the para-sympathetic. But, in the case of the pupils they are antagonistic, and in the ciliary, they assist each other.

Dr. Atkinson's conception is, in the ciliary the impulses are derived, through the sympathethics, from organic metabolism and functional activities. It possesses two sets of opposing muscle fibers, the circular and the radiating fibers, which, when in action, undergo the same reciprocal innervation-inhibition as the extrinsics.

The writer's conception is this: In the absence of any definite evidence, it is safe to follow, in our reasoning, along lines with the general plan of the whole system. Our difficulty is this: on one hand, we are more or less certain that the eye is linked with the vegetative system, on the other hand, we cannot satisfy our mind that, when we hold a light in front of a pupil, the physical energy of light is transmuted into sympathetic motor reaction, in defiance of the law of differentiation. Nor can we understand how the reflex of accommodation, in response to physical radiation, is purely vegetative. Nor is it for a reflex action to involve inhibitory energy. Physiologists maintain that the source of inhibition is in the higher centers.

To harmonize with all known facts, we are forced to draw the following conclusions: The circular fibres, of the ciliary and pupil, are energized by tracts from the spinal-cerebro. The positive reaction must, exclusively, be sensory-motor, and a part of the special sense, to be consistent with the law of differentiation. The radiating fibres of the ciliary and pupil, are not directly involved in the positive reaction to light, and are energized by the sympathetic.

Two different systems of innervation for the two sets of fibers. The method of their functions does not call for reciprocation, inhibition or, in the general sense of, antagonistic action. In the instance of the pupils, the sympathetic energy expresses a constant, or a tonus, in the radial fibers to keep the pupils dilated, which is overcome by the sphyncter's reaction to light. The afferent and efferent, thus, form a complete circuit, and the moment the light ceases the radial fibers resume their form.

As to the function of the sympathetic in the accommodation. Let us reflect for a moment on the method of accommodation in the great, great past. In the very primitive stages of the organism, the animal was constantly engaged in seeking food at close proximity. Myopia was the normal eye; as the adaptation for the immediate requirements of the animal. But, at times he had to accommodate for the distance to watch his enemy. With vegetative nerves in dominant control, the act of accommodation consisted by expanding the pupils, for a greater amount of radiation and pull the cornea and lens, by the extrinsics and intrinsics, towards the retina.

The reason we offer this hypothetical proposition is this: If it be true, what we said about the vegetative system, that it represents the most vital and original organs, and all other structures have evolutionized for its protection and maintenance, then, we must show a logical possibility

how the vegetative fibers existed in the eye, long before the other fibers came into control.

These radiating fibers, which pull at the sclera-corneal junction and pupil, as found today, are the remnants of those bygone stages. Economy of development has retained these structures. By constantly modifying and abolishing the useless parts, and retaining the portions which are useful.

Graham's definition of the osmotic forces may well be applied to organism in general. Every organic structure is the conversion of chemical affinity into mechanical effect. The normal mechanical action is directly dependent on the physical properties of the structure, which are an expression of the chemical affinities.

The mechanical action of the structure, whether passive or active, will develop or overdevelop its physical properties, as long as the supply of the nutrition is sufficient. When the nutrition is inadequate a retrogression must, of necessity, take place in the physical properties. We stress these points because it has a bearing on all our work in the refraction room.

The following is a brief resume of the mechanical actions within the eye, and we will show the direct application of the aforestated principles.

The internal tissues of the eye are fed by a colorless lymph, which currents are produced by osmotic forces.

The mechanical effect of the septum its interstices allow free passage to the watery fluid, obstructing the passage of the thicker fluid. This gives rise to a higher viscosity in the vitreous, which acts as a cushion, to some extent, against the pressure.

The crystallization of the lens has developed by constant pressure.

The cupping and hardening of the cornea, by its exposure to direct pressure.

The protection of the walls of the aqueous chambers by the radiating fibres from direct presure.

The static and dynamic curvature of the lens, as expressed by the hydro-pressure and the tension of the ligaments.

The contraction and dilatation of the circular band, controlling the tension of the ligaments.

The lag of accommodation is, mechanically, effected by the dilatation of the circular band. The anomaly is most common in all eyes. The early investigators studied this subjectively; by applying fogging lenses with a near fixation, and the amount is determined when the letters blurred.

Sheard, Bestor, Tait and others have studied this phenomenon—objectively; with the skiascope, which is by far the better way, the amount is determined by the neutralization of the "with" movement.

In emmetropic eyes, the lag varies according to age, from .25 to 1.

diopter. In ametropia, the lag is from 1.50 to 2. diopters. We have seen, in some rare cases, a lag as high as 6. diopters. These findings are based on objective investigations.

The constant changing of the eyes from near to distance, or from distance to near, develops a muscular sense which is an active process in the two directions; the positive accommodation is performed by the contraction of the circular fibres; the negative accommodation, by the dilatation of the same, both are an active process. Whether the dilatation is performed by a special set of fibrilla or it is, merely, an expression of tonus, we cannot say. However, we must assume it to be an active process.

Lenticular-astigma-compensatory is due to an over-development in the ciliary. The visual field and the rotations of the eyes are greater in the horizontal than in any other meridian, and we may say that the nutritional pathways are more permeable in this meridian. When an overdevelopment is present in the ciliary, the excess is, relatively, greater in the horizontal. It is usually present in the young, or at period of growth, when the corneal astigma is in the making. On one hand, the excess in the ciliary body creates a tension through the radiating fibres, on the cornea, to flatten its curve in this direction. On the other hand, it releases the tension of the ligaments in this direction. The lenticular astigma against the rule, thus, compensates the corneal astigma with the rule.

Lenticular-astigma-organic is due to changes in the elastic properties of the lens. It is most common in the presbiopic stages, and the horizontal meridian is, generally, affected first. Quite often there is a shrinkage in the horizontal meridian of the cornea, showing astigma against the rule, which is due to the low tension of the ciliary body.

The Contracted and Distended Eye Ball

The size of the eye ball is a condition of equilibrium between the hydro pressure and the cohesive resistance of the sclerotic. The physiological equilibrium may be disturbed either by a change in the pressure or in the quality or quantity of the nutrition, which determines the physical properties, or the cohesive resistance of the sclerotic.

When the supply is in abundance, the excessive pressure accelerates the development of the physical properties in the sclera, resisting the normal expansion of growth, and the ball remains contracted. When the supply is inadequate; retarding the physical properties of the sclera, the hydro pressure takes the upper hand, and the ball is abnormally expanded.

There is specific direction of growth, by some remote control or causes, which is congenital in every individual. For this reason we find a general relation between the size and shape of the eye and size and shape of the head. The conditioned state of the normal growth, is a continuation of processes, as determined by the congenital potentialities, and is,

mechanically, expressed by the equilibrium between the hydro pressure and the cohesive resistance.

In the contracted eye ball, we find the optic disk cupped, by the hydro pressure. For the same reason, the disk is distended in the expanded ball.

The Influence of the Tension of the Extrinsics on the Formation of the Eye Ball

Figure 3 explains the effect of the tension of the extrinsics on the eye ball. C represents the center of rotation. P P′, anterior and posterior poles. E E′, the equator. R R′, the plane of attachment of the recti, anteriorly to the equator. O O′, the plane of attachments of the obliques, posteriorly to the equator.

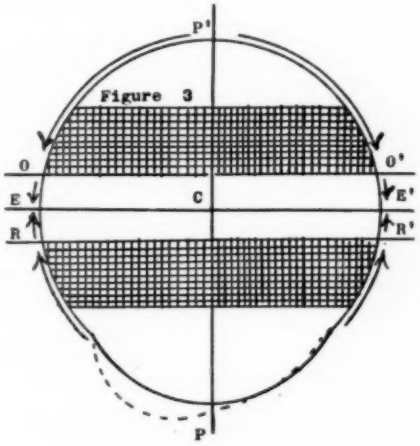

Figure 3

In the structure of the sclerotic we find in the inner layer the direction of the fibres are longitudinal, in the outer layer, meridianal. These two sets of fibres are bound together with connective tissue, and form a cross net work, as shown in Figure 3. The combined action of the recti is to pull the anterior portion of the net work, inwardly, towards the equator. The action of the obliques is to pull the posterior portion of the net work, outwardly, opposite to the anterior pull. The combined action of all the muscles creates an effect of a globular tension all around, as if the ball were suspended in the air, thereby eliminating any possible compression against the socket.

The sclerotic coat is thus packed and hardened by external tension of the extrinsics and the hydro pressure from within.

Had the attachments of the muscles been on a tangent with the equator, there would be no tension on the ball. As the whole of the muscular force would be expanded on the rotations of the same. But, not being on a tangent, the muscular force becomes divided; one part of

which is expanded, on the rotations, and another on the tension.

It is evident that the further the attachment of a given muscle is from the equator the greater the share of its force on the tension. The following figures give the position of the attachments for the different muscles. For the recti the measurements are taken from the nearest border line of the cornea. For the obliques, from the point of entrance of the optic nerve.

The Recti

Internal 5.5 mm. from the corneal border.
Inferior 5 to 6 mm. from the corneal border.
External 6.9 mm. from the corneal border.
Superior 7 to 8 mm. from the corneal border.

The Obliques

Inferior 4 to 5 mm. from the entrance of nerve.
Superior 7 mm. from the entrance of nerve.

A glance at these figures shows that the nasal side of the eye ball is more under the influence of the muscular tension than the temporal side. At the anterior portion of the globe the internal exerts the highest tension. At the posterior end, while one turns the eye up and the other down, the two turn the posterior pole in, nasalward. By this the whole of the temporal side is more subjected to the influence of the hydro pressure. For this reason, the myopic crescent, or atrophied tissues, by the various diseases of the fundus, almost always have their beginning in the temporal region.

The corneal curve, as shown in Figure 3 by the broken lines, represents the condition of the curvature of the cornea in keratoconus. It shows how the summit of the cornea is shifted to the temporal side. This can be readily seen with the ophthalmometer, by the difference in the size and shape of the two reflected mires, as the difference of the curvature of the cornea, on either side of the visual axis, is very pronounced.

The Formation of the Fovea

The visual axis, generally, does not coincide with the optical axis. The deviation thus formed is called the angle *a* or *alpha*. Javal attributes this to a decentration of the lens, Tscherning, to the displacement of the fovea. These two opinions are essentially the same. It is evident that some force, other than the optical rays, is involved in the making of the fovea. For, if the concentration of the optical rays would involve the making of the fovea, the two axes, the optical and visual, would always coincide.

We are inclined to reason that the osmose is involved in the making of the fovea. Being the most active region in the retina, it becomes necessary to place it at point of concentration of nutrition, or the focalization of the osmotic currents. The zonule of Zinn encircles the lens, and its currents are focalized on the fovea. The depression in that region is evidence of the pounding of the currents. This explains the existence of angle *a*, as the two axes, the visual and optical, are

the products of different elements. The optical axis is expressed by the refractive surfaces, and the visual axis, or fovea, is the product of the chemical action in the circle of Zinn, any organic discrepancy, in the harmony of the elements involved, will create the angle *a*.

The Formation of the Cornea and Corneal Astigmatism

The cornea is shaped like a minus meniscus lens; thinner in the center and thicker at the edge. It is divided into two parts: *optic* and *basilar*. The optic is the center part of the cornea, about 4 mm. in diameter, or an angle of 30 degrees, about one-third the width of the cornea. Its curvature is almost spherical. The basilar is the peripheral part of the cornea, its curvature is elliptical.

It is evident that two components are involved in the shaping of the cornea; hydro pressure and muscular tension. According to the laws of physics, the pressure cannot involve ellipticity and muscular tension sphericity. The fact that the cornea is partly spherical and partly elliptical, shows that it is under the influence of pressure and tension. Again, the pressure cannot develop one part of a structure more than another, as its force is constant at every point of contact. The fact that the cornea is thicker at the periphery, shows the influence of tension.

The abruptness of the curve at the corneal border shows the effects of an internal pull by the radiating fibres at the corneal junction. Had the tension of the extrinsics been involved, the curve on the corneal border would be more gradual and continuous with the curve of the sclera.

The spherocity on the optic part shows the dominancy of the hydrostatic pressure in this region. The ellipticity and thickening at the basilar part shows the effects of the interference of the directional muscular tension. It is very similar to the action of the lens as explained before.

In a general sense, the cornea is classed as a passive structure. But some minute changes must take place in the act of accommodation. With every increase in the hydro pressure there is a tendency to distend the ball and the cornea and the function of the radial fibres is to resist expansion. For this reason we find these fibres more numerous than the circular, as their function calls for more brutal force. Which, also, explains their presence in myopia, they are there to resist expansion.

Hydro pressure is constant in all meridians, but muscular tension is subject to organic variations in the different meridians. The effects of the components on the formation of corneal astigma can be explained best in connection with our tests.

Example 1. The ophthalmometer reading shows an astigma, with the rule of 1 d., and the subjective test shows no astigma. Our interpretation is this: The cornea has a sharper curve in the vertical meridian, evidently there is less resistance, to the pressure, in this direction. Indicating that the cornea is thicker in the horizontal meridian, which is due to the higher tension of the radiating fibres in that direction. As the influence of the tension is greater at the periphery, the thickening of the

cornea is relatively greater in that region, expressing a sharper curve in the horizontal of the posterior surface.

But the astigma on the posterior surface cannot compensate in full the astigma on the anterior surface, as its refractive value is limited by the difference in the indices of the cornea and aqueous. The fact that the anterior astigma is fully compensated, shows that the circular fibres are more active in the horizontal, expressing a sharper curve on the lens in this direction. This condition is, generally, present in the young, with hyperopia in the making.

The few corneas which Tscherning measured showed a sharper curve on the posterior surface in the horizontal; on the anterior surface in the vertical. Such condition is possible only when the horizontal meridian is thicker.

Example 2. The ophthalmometer shows an astigma of 1 d., and the subjective test .50 d. Every excess is followed by retrogression processes.

In this example we see the excess in the ciliary decreasing and entering a stage of retrogression while the excess in the horizontal of the cornea is still persisting. This condition is very common in adults and pre-presbiopic stages. It seems that the persistency of the cornea changes with age. The young cornea is subject to changes; in the adult life it assumes a passive state to change again at the presbiopic age.

Example 3. The ophthalmometer and the subjective tests show the same amount of astigma. This condition is the next step to example 2 in the retrogression process. It should be understood that we are not aiming to emphasize quantities, but, rather the order of the progression of the processes. With every decrease in the activities of the ciliary there is, relatively, a decrease in the tension or in the excess of the cornea. The young cornea with one diopter astigma may show at the presbiopic age no astigma, or, some against the rule.

Example 4. The ophthalmometer shows some astigma with the rule and the subjective against the rule. This condition is one of the types we meet in the presbiopes. Evidently the degree of the resistance in the cornea varies with the individual and so is the pressure. In some, the cornea hardens with age, and the astigma on its surface is still persisting, while the low activity of the accommodation is expressing a lenticular astigma, which more than offsets the corneal astigma. In others, under the same conditions, the low activity would express in the cornea, no astigma, or, against the rule. As pointed out before, the positive accommodation is performed by the contraction of the circular band, the negative accommodation, by the dilatation of the same. In advanced stages of retrogression both of these functions become affected, slackening the ligaments and the lens is subjected to hydro pressure. When these effects are greater in one meridian, it will express lenticular astigma.

Example 5. The ophthalmometer and the subjective tests show no astigma. This condition is typical with the young myope in the first

stages. Although young and energetic, there is no excess in the cornea or ciliary, as the condition of the eyes does not call for excessive accommodation. On the other hand, if we should find a young myope with corneal astigma, and the subjective test shows that it is fully covered, we will have a suspicion that part of the myopia is accommodative.

The same is true when the ophthalmometer shows an astigma, with the rule and the subjective test against the rule. The difference between this condition and the one we pointed out in example 4 is age. Corneal astigma, with the rule, as seen by the ophthalmometer, in the young it means excess, in the old it means persistency. Lenticular astigma as seen by the difference between the ophthalmometer and subjective tests, in the young, it means excess, in the old, it means advanced stages of retrogression or degeneration. So, when we find in a young myope, a condition like example 4, it means accommodative myopia.

Example 6. The ophthalmometer shows no astigma and the subjective test, some astigma against the rule. This is another type found in the presbiopic stages, but we meet the same in all ages, even in young. We have stated every excess is followed by a retrogression and the reverse is true; every retrogression stage has had its beginning in excesses. This is the life-cycle in every structure. It seems that the activities in the horizontal meridian are first in excess and first in retrogression. When the supply is inadequate, whatever cause there may be, the horizontal meridian of the ciliary is first to become affected. This gives rise to an uneven tension on the ligaments of the different meridians, and the pressure takes advantage in expressing a cylindrical curve on the lens.

Example 7. The ophthalmometer shows an astigma against the rule and the subjective test also against the rule, but of a higher degree. This is the next step in the process to the condition pointed out in example 6. The low activities of the ciliary in the horizontal are extending their effects into the cornea. They give rise to an uneven tension of the radiating fibres in the different meridians and the pressure expresses on the cornea, an astigma against the rule. We may say that while the cornea and lens are under the same degenerative influence of the ciliary, the difference in the findings between the ophthalmometer and the subjective, represents the difference in the resistance of the cornea and lens. The higher the resistance in the cornea, the greater the difference in the findings of the two tests; the lower the resistance, the less the difference. We can apply the same reasoning with respect to the pressure.

It is obvious that by studying the relative values of the findings of the ophthalmometer and subjective tests, age, and nature of ametropia, we can get a clear conception of the high or low activities of the ciliary, the changes in the curvature of the lens, the high or low tension in the radiating fibres, the nature of the curvature of the posterior surface of the cornea, the relative resistance of cornea or intensity of pressure.

All ametropia are congenital and acquired. The tendency for the ametropia is congenital, the degree of the ametropia is acquired. But it

is best to apply these terms in the relative sense; when the degree is high we say that the congenital factors are in preponderance; when the degree is low, we call it acquired.

From clinical observations we have learned that the highest amount of corneal astigma, which the ciliary process could cover, is from 1.50 to 2. diopters. Complaints of asthenopia are almost always accompanied by a corneal astigma of 1.50 d. under cover. At 2 d. visual acuity becomes disturbed and the effort is abandoned. All low degrees of astigma, up to 1.50 or 2. diopters may be taken as acquired condition. The higher degrees of astigma are a continuation of the congenital potentialities. In true myopia, all astigma may be taken as congenital except low degrees of corneal astigma, against the rule, should be classed as acquired.

Talbot defines the developmental stages of man from the primitive cell as evolution and involution. The intrauterine period as evolution, the extrauterine development as involution. The whole development is in six stages, or periods of stress. It is at these periods of stress that new structures develop and others disappear under the law of economy of growth. These periods of stress are critical moments in the life of the individual.

The first period is the development in the utero. The second period is the first dentition to the third year. The third period, the second dentition; the sixth year. The fourth period during puberty at 14, at which time the generative organs begin to be functionally active. The fifth period the climacteric, when uterine involution occurs in woman and prostatic involution in man, at 45. The sixth period around 60, the stage of senility.

Voluntary controls begin to show the effects of their development at the second period. The power to stand upright and to walk, the faculty of speech are developed. Starbismus is first marked at this period of stress. At the third period of stress congenital ametropia becomes pronounced. The fourth period of stress is quite critical for the eyes. We have seen cases in girls with marked disturbance in vision, which may last from six months to a year. From puberty to adolescence is the period when the osseous system reaches its complete devolopment. At this period the cornea and eye ball attain its final development to assume a stable condition. In the fifth period of stress we see the involution of accommodation and the beginning of general retrogression of the active structures.

For several years the writer tried the following experiment: In low myopes with anisometropia, instead of applying the full correction for each eye, he gave the lesser correction for the two. For instance, one eye called for 1 d. and the other, 1.50 d. he prescribed O. U.—1 d. On re-examination, after a year or two, he found in the eye with the full correction the change was very little, if any, while in the undercorrected the increase in the ametropia was very pronounced. This was tried in a number of cases and the result was the same.

These evidences seem to dispel the thought that myopia in the general run of cases is due to an overtone or contraction in the accommodation muscles. As it is difficult to explain how the accommodation becomes more contracted in an eye with an undercorrection, which is less active than the eye which is fully corrected.

Our explanation is simply this: the eye which is fully corrected is more under the control of the brain. With greater stimulation, it receives its full quota of nutrition, increases the pressure and the resisting properties of the sclerotic and cornea, while the undercorrected eye is relatively less under the control of the brain, with less nutrition, and the ametropic process must of necessity advance.

The ideal way of treating the first stages of myopia is this, a near full correction as found at the time of the test and general exercise of all the extrinsics. The object is not to decrease the myopia but to stop its progress, by developing the physical properties of the sclera and cornea. Our attack is made from two directions, the full correction increases the nutrition and the pressure from within, and the exercise of the extrinsics increases the globular tension externally. By this the sclerotic is developed and hardened to resist expansion.

In conclusion, we may well quote the words of the great Porterfield: "From all which everybody may see, what a noble piece of geometry is manifested in the fabric of the eye, and the manner of vision. There is not one part of the whole body that discovers more art and design than this small organ: All its parts are so excellently well contrived, so elegantly formed and nicely adjusted, that none can deny it to be an organ as magnificent and curious and the sense is useful and entertaining."

BIBLIOGRAPHY

Atkinson—"Tonus and Reciprocal Innervation." Optometric Weekly, Nov. 24, 1932.

Cooke—Chemical Physics.

Gray—Descriptive and Surgical Anatomy.

Levin—"Study of Causes of Ametropia." Optical Journal and Review, May 10, 1929.

Maddox—"Heterphoria." American Journal of Physiological Optics. Jan., 1922.

Norris-Oliver—Ophthalmology.

Tscherning—Physiologic Optics.

Talbot—Developmental Pathology.

Wiseman—"A Study of the Visual Portion of the Autonómic Nervous System." American Journal of Optometry, Vol. 7, No. 12.

DR. NATHAN LEVIN
101 WASHINGTON
CHELSEA, MASS.

FUNDUS DISEASE*

D. R. Paine, Opt.D., F.A.A.O.
Topeka, Kansas

Optometry is indebted to its own fraternity as well as to that vast group of society to which our profession administers ocular service, to come to a better understanding of pathology both local and general as related to eye symptoms.

Prompted by the belief that the more that is written in an elementary understandable fashion on these topics, the more quickly will be awakened an interest in the study of these much neglected subjects, I am submitting this attempt at an elucidation.

Among the rank and file of Optometrists the one most neglected field of study is that of fundus diseases and yet the highest standard of success cannot be attained without a knowledge of what constitutes a normal or subnormal status of intra-ocular processes. It is not only an easy task to learn with the Ophthalmoscope, to differentiate between health and disease, but the study of the intra-ocular circulation is most fascinating.

"Little was known of the living retina until Helmholz in 1851 discovered the opthalmoscope." This invention stimulated extensive studies and opened an entirely new vistae for the better understanding of diseases both ocular and systemic. To remain in ignorance of this important field of understanding is to revert back in ability to recognize visual interferences, to an era when practice was to a comparative extent shrouded in ignorance.

The pupil is an open door, inviting those with understanding to study the secret processes of its hidden chambers. This is the only place during life where the exposed blood vessels can be visibly explored and where circulatory pulsations and pathologies can be studied to so great an advantage.

In this alluring study of the fundus interest grows with understanding. Mystery vanishes, when we realize that circulatory disturbances in the eye represent similar conditions throughout the body. Albuminura, diabetes, syphilis, arterio sclerosis and the like, as manifest within the eye, are merely the reflections of those conditions which exist elsewhere in our body economy.

*Submitted for publication April 18, 1933.

The reason that so many bodily ills can be detected early in the eye, before being manifest in other parts, is due to the fact that retinal arteries are only end-arteries and are thus more easily affected by systemic toxins, the arterial walls being thinner are more easily disintegrated or broken.

Great accuracy is not required by the optometrist to diagnose pathological lesions. It is first necessary to measure with moderate approximation the refraction with the opthalmoscope. Turn in plus or minus lens power until the light streaks in the retinal arteries are visible. It is then easy to detect elevations and excavations. If there is an elevation due to an exudate, this point will be more hyperopic than the surrounding area, just as an elevated choked disk will be more hyperopic than the general plane of the retina. Conversely, a cupped disk will, because of its excavation, measure more myopic than the surrounding area. With this mastered it is easy to recognize many of the pathologies such as detached retina, choked disk, glaucoma, diabetes, and albuminuria.

What to disregard and what to regard in order to simplify opthalmoscopy. If we know what constitutes a normal fundus, we can in a very general way disregard the color of the retina because there is such a wide variation in fundi color among perfectly healthy individuals. In color and exact appearance two fundi are no more alike than any two faces or any two complexions. In their elaborate descriptions of fundus diseases, many of the text books confuse the student of opthalmoscopy with unnecessary detail, much of which is without significance.

Facts of cardinal importance to be regarded are: That retinal arteries are approximately one-third smaller than are the veins; that the vessels emerge at the approximate center of disk (if at extreme edge a picture of glaucoma is seen) and ramify across the fundus; that there may or may not be visible a white scleral ring around or partly around the margin of the optic disk and a dark choroidal ring on the outside of the scleral ring and that these two rings are not pathological; that the optic disk is a blind spot.

In the exploration of the fundus, if the veins appear normal in size and the arteries very small and withered, there is a possibility of atrophy and the fields should be taken immediately. If the retinal vessels are engorged, tortuous and twisted, retinitis is probable. If the vessels enter at the disk margin and bend abruptly over the edge of disk, instead of entering near the center, there is a definite picture of glaucoma and again the fields should be studied. If the nerve head is higher, more hyperopic than the surrounding area and if the emerging vessels from the disk seem to bulge forward, a condition of choked disk is presented.

Do not definitely and conclusively diagnose as optic nerve atrophy, a white or gray nerve head without verifying with a field study.

If lesions are present and the patches of white or black are on top of the vessels, the pigment is in the retina; but if the vessels run over the spots the trouble is beneath the retina in the choroid.

If spots appear on the temperal side of the retina in the region of the yellow spot (macula) and this is associated with poor vision, the condition is central choroiditis.

If any particular retinal area is by contrast much lighter in color than the surrounding parts, and this white area is in folds with the vessels riding or following the course of the folds, the retina is detached. While sarcoma presents a similar picture to that of detached retina, the difference lies in the facts that with sarcoma the folds are not present and the vessels therefore do not break or follow any folds but run a straighter more uninterrupted course over the diseased area.

"Where the blood vessels emerge from the disk, due to its change in caliber upon emptying and filling with the heart beat, the pulsation can be studied. A venous pulse is considered physiological, but an arterial pulse is pathological and highly diagnostic." This pulsation can be artificially produced by vigorous pressure against the globe. As a rule when the macula or retina in general is affected, the vision is reduced in proportion to the extent of the disturbances and the area involved. If vision is impaired and the underlying disease not sufficiently advanced to be detected by the opthalmoscope, field study should be employed.

After making a thorough exploration of the fundus by means of which no lesions have been detected, yet the patient has poorer vision than can be accounted for in refractive error or field study, the final investigation, before resorting to health check, should be for amblyopia.

In treating so vast and important a subject in such brief fashion, the paper is intended merely to introduce one meager chapter to that huge volume of need, trusting that as a result of which further contributions will thus be stimulated.

DR. D. R. PAINE
NATIONAL RESERVE BUILDING
TOPEKA, KANSAS

PRACTICAL PSYCHOLOGY IN REFRACTIVE WORK*

Samuel H. Robinson, O.D.
Prescott, Arizona

From time to time we read that a knowledge of psychology is essential to good refraction. This statement is vague if not properly qualified.

The word "psychology" used in connection with refractive work often carries a questionable inference. The spectacle-man of old made much use of a certain brand of "psychology." He used it to bear undue influence upon his prospect. His applied psychology was for the purpose of winning undeserved confidence and respect. He would control the judgment of his customer by playing upon his credulity and emotions. Impressing him with his presumed skill and erudition, the early spectacle-vendor could make his coveted sale at an extortionate profit. This is the sort of a picture we conjure perhaps, when we hear the word "psychology" linked with modern refraction.

It is not necessary, however, that we shall accept such an interpretation. A knowledge of psychology in refractive work is quite as essential as it is in all other human relations. The application of sound and practical psychology to optometric work offers many mutual advantages both to the patient and examiner. Psychology in refractive work is the exercise of such inherent or acquired analytical powers as are essential to the correct handling and consummation of a refractive case.

All persons in business or in the professions are good or bad psychologists, achieve success or suffer failure, in the measure that they can quickly sense the essential facts or elements in any problem, can correctly correlate them in relation to the ultimate goal, and have the acumen to discern what are generally considered imponderables,—of small consequence,—but which in fact, exercise a definite control over the destiny of the situation.

To explain the thought in the foregoing statement, let us refer to some specific illustrations.

A woman is fitted with bifocals. She comes back with the complaint that she can not wear the glasses,—they are useless. The examiner is all to blame, and her money has been wasted. Apart from a correct knowl-

*Submitted for publication April 15, 1933.

edge of his refraction, the examiner, if he were psychologically keen and alert, should have observed perhaps these important facts concerning his patient.

1. That she was getting her first pair of bifocals.
2. That she is emotional, easily discouraged and highly apprehensive.
3. That she does not appear able to readily adapt herself.
4. That she is rather vain, and sensitive to personal problems.

We shall not attempt here to analyze the accuracy of the above deductions. Let it suffice to say that careful observers will often sense accurately a train of facts from a single observation, and without making any pretense at emulating Sherlock Holmes, either. We shall presently cite a case in which the premises for conclusions are purely inductive and hence are not at the mercy of false deductions.

However, reverting to the case in question; assuming that the examiner had properly deduced the facts concerning his patient as above indicated, he would now be in a position to act as follows:

"Mrs. So-and-So," he could have said at the conclusion of his examination, "I find that your requirements for distance or general wear and for reading or sewing, are not the same. That is to say, the glass that you can see with in the distance will not permit you to read or sew with comfort. The glass for near work, on the other hand, will necessarily be very blurred in the distance. This means, that you will require a distance glass and a reading glass. We do, however, often combine the two lenses in a single glass. You have seen many of them, no doubt. They are called bifocals. I am very dubious, however, about recommending that combination in your case."

The examiner will not, of course, openly convey his reasons for not recommending the bifocal in this case. Neither does he need to insistently and urgently discourage the bifocal. For, in fact, he may sometime meet a case in which his deductions are not wholly correct. But, through an exchange of ideas along this line with his patient, he will have strengthened his own analysis of the situation, and finally, should the patient decide on a bifocal despite the examiner's genuine apprehension, the latter has now freed himself of much if not all responsibility.

And now let us take the case of the average business man at about 50. He calls to have his eyes examined for glasses, and dwells on the fact that he is beginning to experience some difficulty with his old glasses when reading. This case seems usually, on the mere face of it, very simple. And in fact, it really is so. The prescription is perhaps one of ordinary presbyopia carrying a spherical correction. There are no other complications. The patient seems jolly and easy-going. The big idea he seems bent on putting over is that the old lenses are a bit weak and he needs a stronger correction for reading. The glasses are prescribed with that thought in mind, and delivered to the patient. In several days, our friendly patient returns with his face a bit wry. He does not know just how to explain it, but the glasses seem uncomfortable. He

does not seem able to use them in his office as he did the old ones. In fact, he is now using the old lenses.

Here is a case that could not have been handled by deduction but should have been considered inductively. The outward and apparent indications justified the manner in which the case was handled. Those cases are by far the most difficult to handle psychologically, because what appear substantial objective facts hide from view deeper hidden considerations. When the examiner is once made alive to this situation, however, he should have little difficulty in being ready to measure this angle of his refractive work. What in fact had been overlooked in the case of our business man, and how should his case have been handled?

In the first place, the examiner took it for granted that all his patient wanted was a reading glass,—a glass that would make nightly reading by his fire-side more comfortable. His examination verified this need, because with the old glasses his patient had a near-point of about 14 to 15 inches which is obviously too far for protracted near work. Our examiner further failed to recognize the importance of knowing for certain how the new glasses were intended to be used by his patient. By induction our examiner should have visualized how a business man sitting in an office at a desk, with typewriters, adding machines and other office equipment lying around, is likely to want to use his eyes. The range provided this man was excellent for purely close reading. If the examiner had the acumen to visualize the facts, he would have probably advised his patient that such a glass as he needed should be used at home for nightly reading, and in the office for prolonged close work. A man wearing a reading glass with a far-point of 24 to 30 inches, and accustomed to view things scattered about his desk at arm's length, with a clearness bordering on impunity, could never feel satisfied with a good reading glass that casts a blur 20 inches away. A similar condition prevails among merchants and clerks of presbyopic age who must of needs see and meet people in the distance, read the smallest of price-marks held in the hand, and at the same time recognize articles by small labels resting at various elevations along the shelves. Indeed, despite our best efforts, we have a serious problem to confront when attempting to match with lenses of glass the accustomed visual ease and facility permitted by the elastic ciliary and ocular lens.

The practical illustrations along the line of our discussion could be continued *ad infinitum*. Human reaction to lenticular correction in all its phases and ramifications, would offer many chapters of absorbing interest. How to handle or circumvent much of this reaction, constitutes, in fact, the substance of our profession's development. Whether we devote our efforts through purely technical channels to satisfy the call of a lens-needy world, or whether,—recognizing our limitation in the single direction,—we bend much effort in the path of the essential and highly coordinate mental or psychological realm, a single purpose and goal lies before us, namely to give the world a higher and more intelligent eye

service,—the human eye a greater comfort, the body a sweeter rest.

DR. SAMUEL H. ROBINSON
BASHFORD BUILDING
PRESCOTT, ARIZONA

METHODS AND CASE REPORTS IN CERTAIN PHASES OF OCULAR PHYSIOTHERAPY*

L. H. Kraskin, Opt. D., F. A. A. O.
Washington, D. C.

Some time ago I read an article in a medical journal describing the successful treatment of a number of ocular conditions by physical therapy, although all known medical treatment had proven inadequate.

I became very interested, hoping that physical therapy might prove an efficient complement to the present day accepted standard optometric methods of treatment and make these measures even more effective and being cognizant of the fact that physical therapy in various forms has been practiced on the human body for years by members of the healing-art professions with a high degree of success. Very often in administering optometric treatments for amblyopia, building up the ductions, strabismus, etc., we encounter difficulty in obtaining the desired results and after numerous treatments without any noticeable improvement we feel inclined to give up the attempt and dismiss the case. And realizing that we meet a large number of these stubborn cases, the possibility that by adding a physical therapeutic agent as a complement to our present techniques, we may attain the sought-after results, encouraged me to further investigate the subject.

Acquiring the knowledge of the principles and application of physical therapy and purchasing the necessary equipment, I began my study and research. Soon afterwards Dr. J. I. Kurtz appointed me a member of the Academy's Committee on Ocular Physical Agents.

From my years of contact with several phases of this work I can conservatively state that physical therapy has a definite place in ocular therapeutics from both the viewpoint of optometry and ophthalmology. It must also be understood that I am not suggesting these therapies as cure-alls, but as an aid in the treatment of the more difficult optometric cases.

The following interesting cases present features not met with in the everyday practice, although they may not be classed as unique. I

---

*An abridgement of the material presented before the American Academy of Optometry at Philadelphia, December 6, 1931.

am not attempting to give explanations for the reactions in these cases. I want to merely cite them as I found and corrected them.

Before starting treatment and although my examination and the patients' history are negative in reference to their general health, I still make it obligatory upon the patient to visit a good internist for a general examination, and if his report coincides with my findings, I begin treatments. In this manner I establish co-operation between the physician and myself and rule out all possible contra-indications.

For the purpose of brevity I have condensed my examination findings and will only relate what I consider the most important diagnostic po.nts in the following cases:

Case 1

Mrs. H. E. N., age 28, occupation, clerk; general health, constipated; nervousness and a general tired feeling. Complains of eyes aching, itching, lachrymation, and blurred vision at far and near; also temporal headaches.

Examination revealed the following: On the right upper lid a chalazion and on the right lower lid a marginal chalazion. Had consulted oculists about the lid lesion and was advised to submit to operation, which she refused. Fundus negative; visual acuity—without glasses —right eye 20/40 —; left eye 20/50 —; Ou. 20/32 — 1. The ophthalmometric, static and dynamic skiametric findings were of a normal ratio and coincided with the subjective findings which were as follows: O.D. — 0.25, — 1.25 cyl. ax. 100, which gave her V.A. 20/20 — 1. O.S. — 0.25, — 1.25 cyl. ax. 90 which gave her V.A. 20/20 — 1. Her habitual phoria at far was 2 P.D. exophoria and at near 6 P.D. exophoria. With correction, her induced phorias were the same as habitual phorias. Her ductions and fusion reserves were normal. The necessary glasses were prescribed.

She was greatly concerned about the chalazions and was anxious to have something done, other than an operation for their removal. I informed her of my investigations in ocular physiotherapy and suggested that if she were willing to submit, I would do what I could to remove them. She gladly submitted to treatments and the following treatment was administered:

Treatments were given three times a week. The first six treatments—Tesla Auto-Condensation. The patient lying on the Auto-Condensation pad and mesh electrode covering her eyes. The following 18 treatments—Indirect Tesla. The patient sitting on the Auto-Condensation pad, and I using one or two fingers as an electrode over the eyelids massaging the chalazions in both horizontal and vertical directions. This was given for about 10 minutes and then followed by sedative diathermy, using mesh electrodes over the eyes and a metal electrode at the nape of the neck. This was given to toleration, for a 20-minute period.

The results were surprising and gratifying, as the chalazions had entirely disappeared, all symptoms subsided, and upon examination, I found that her visual acuity without glasses had improved to O.D. 20/32 + 2, O.S. 20/40 — 1, O.U. 20/32 + 2, and that she now needed a weaker correction, which was prescribed as follows: O.D. — 1.00 Cyl. Ax. 95, O.S. — 1.00 Cyl. Ax. 90.

It has now been approximately one year since her discharge and the patient is still very comfortable and there are no signs of the recurring of the chalazions.

Case 2

Miss S. M. C., age 31. Occupation, school teacher. General health good, except for migraine from which she has been suffering since childhood. She described attacks as extremely severe and that she would become prostrated and had to immediately go to bed and resort to sedatives for relief. The attacks usually lasted for a day or two and were quite regular and an attack would usually precede her menstrual period. She further stated that her mother, her maternal grandmother and brother were sufferers from migraine and that she had resorted to all sorts of examinations and treatments with no avail. She said she didn't expect that I could possibly help this condition as she had had her eyes examined, treated and had been fitted to glasses without securing relief other than aiding her vision. She had lost her glasses and desired to be refitted, as she was experiencing great difficulty in reading.

Examination revealed the following: Visual acuity without glasses—O.D. 20/40 —, O.S. 20/20 — 1; fundus negative. The ophthalmometric, static and dynamic skiametric findings were of a normal ratio and coincided with the subjective findings, which were as follows: O.D. — 0.25 — 1.00 Cyl. Ax. 90 which gave her V.A. 20/20 — 1. O.S. — 0.50 Cyl. Ax. 90 which gave her V.A. 20/20. Her habitual phoria at far was 1 P.D. of exophoria, and at near 3 P.D. — esophoria. With correction her induced phorias were the same as habitual phoria. Her abduction was break at 4 P.D. and recovery — 1 P.D. Her near point positive fusion reserve was break at 19 P.D. and recovery at 9 P.D. Her negative fusion reserve was break at 16 P.D. and recovery at 15 P.D.

From the diagnosis of these findings, I informed her that I believed the eye condition a possible contributory factor to her general condition and advised treatments for same. She willingly consented, stating that she would be grateful for any relief possible.

Treatments were given three times a week. The first six treatments—Tesla Auto-Condensation. The next 18 treatments—sedative diathermy, followed by ocular prism treatments, in order to build up her abduction and negative fusion reserve. Upon re-examination a considerable improvement in her abduction and her fusion reserve was noted. Same increasing to abduction — break 8 P.D. and recovery at

6 P.D. Negative fusion reserve break at 24 P.D. and recovery at 18 P.D. And also noted a decrease in her refractive error to the following: O.D. — 0.75 Cyl. Ax. 90, which gave her V.A. 20/20 — 1; O.S. — 0.25 Cyl. Ax. 90, which gave her V.A. 20/20. Her glasses were changed accordingly.

Although her symptoms had decreased only slightly in severity, but encouraged by the improvement in her ocular condition, I suggested that we continue the treatments and gave her twelve more—diathermy, followed by the ocular prism treatments, but with only a slight further improvement, and patient was discharged.

She returned five months later complaining that her symptoms were as severe as ever, and that the improvement that we had accomplished had all disappeared. About this time in the course of my research, I came across a short article by Dr. C. M. Sampson and advised her of same. (See footnote.) She anxiously submitted to the treatment as outlined by Dr. Sampson and I gave her five treatments accordingly. The last treatment was administered about a week before her expected menstrual period and I advised her to please report her condition before and during that time. She later called to inform me that for the first time in as long as she could remember she was entirely free from a migraine attack, which usually preceded her menses.

It has now been approximately six months since her discharge, and the patient is entirely free from attacks of migraine and is perfectly comfortable and happy.

"A PRACTICE OF PHYSIOTHERAPY." C. M. Sampson, M. D.

Whatever may be the cause of migraine, this most distressing ailment, toxic, vasomotor spasm, dysfunction of the pituitary, etc., one clinical fact looms out. In the very great majority of the most severe cases, especially the type that occur at regular intervals, cerebral diathermia will give almost instant relief and in most cases a course of diathermia will break up the cycle and free the patient for at least some years from succeeding attacks. This discovery was accidental. Shortly after the sedative diathermia technic was worked out (1917) and proved safe for use anywhere, and diathermia was not contraindicated, I was called in on one of the worst cases I had ever seen up to that time. The patient was a medical officer in the army, age thirty-four, history negative. He had undergone tests and searches for foci from head to pelvis in many of the best clinics and laboratories in the country with no discoverable cause for the attacks. The attacks were hyperacute, lasted for three days and nights and occurred regularly every fifty days. He had been having them from the age of fourteen years. Diathermia, 250 milliamperes, the sedative technic, was administered anteroposteriorly through the brain with no other thought than that of symptomatic relief. The next day 350 milliamperes was given and the third day 500 milliamperes. He went to sleep during the first treatment, woke up some hours later feeling normal, ate heartily and came on duty the next day—the first time that he had not been completely prostrated for his usual three days. Fearing a return, he took a second and third treatment but refused further treatment after the third day. We were in touch with him for several years after that time but he received no more treatment nor did he have any more attacks of migraine. I have checked this up on quite a few similar cases both in men and women since and have had dozens of my medical friends who have tried it upon patients in their practices report that it is almost a specific.

Conclusion

In closing I want to emphasize that in ocular physical therapy for optometry there is a need for further study and technical research on this interesting and I believe virgin and fruitful subject.

Most optometrists by virtue of their preparation and training in physics, light and other subjects included in the optometric curriculum have a very good background so that with some added study of the principles of ocular physical therapy followed with a series of demonstrations on practical application, they should be in a position to apply these agents intelligently just as much as the dentist, the osteopath, or medical practitioner. I wish to emphasize here that I do not advise any optometrist to add ocular physical therapy to his treatment therapies unless he is willing to spend time and effort to study up on this subject and prepare himself to be able to apply it intelligently. I wish to state that ocular physical therapy where properly applied has proven to be a great help to optometrists. It is true that this science is new and the field undeveloped. Little research has been done to study the effects of the application of physical agents to the eye, especially in cases of interest to the refractionist. Both optometrists and ophthalmologists are guilty in neglecting to develop this new and promising field. The former are to a great extent more responsible than the latter, because the field of the ophthalmologists is so broad that most of their time is taken up with the study of and the treatment of the diseases and surgery of the eye, ear, nose and throat and they have little time to devote to investigation of subjects which are distinctly in the field of optometry. The optometrists must develop their own field themselves in much the same way as the dentists are doing and they must not expect ophthalmology to do the thinking for them. We all remember the chaotic condition that prevailed until recently in the treatment of amblyopia, muscular imbalance, etc. It was not until optometry began a serious study of these problems that vision began to improve in eyes emblyopic for years, and that to some extent satisfactory results are achieved in the treatment of certain muscular imbalance cases. The optometrist should rather be taken to task for neglecting this new and promising field which holds out so much promise for relief to his patients.

Even with the very small amount of research work done in this field, the results are so promising as to encourage all of us who are interested to go in a little farther into this study and research. The progressive and alert optometrist will not ignore this great opportunity for increasing his fund of knowledge for developing his optometric field and the possibility of rendering his patients a more complete and efficient service.

I am convinced that the more proper institutions for this study are our colleges and clinics that have available a preponderance of material which I realize is necessary for proficient research and which

is not possible in the average busy practitioner's office due to the need of control cases, etc.

Was very happy to read that our supposedly conservative English optometric cousins welcomed the study and discussion of ocular physical therapy instead of putting stumbling blocks in the path of progress, which reminds me of my conversation some years ago (in reference to ocular physical therapy) with my dear and esteemed friend and in my opinion one of our outstanding bulwarks of optometry, Dr. Edwin F. Tait, who said, "Let us be open-minded, not ready to oppose, condemn and cast aside without proper investigation but to wait until further study and research have been made and we are sure of our ground."

DR. L. H. KRASKIN,
408 WASHINGTON LOAN & TRUST BLDG.,
WASHINGTON, D. C.

AMERICAN JOURNAL OF OPTOMETRY

VOL. 10 JULY, 1933 No. 7

EDITORS

DR. CAREL C. KOCH
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

DR. JACK I. KURTZ
1501 Foshay Tower
821 Marquette Avenue
Minneapolis, Minn.

Original papers, scientific communications, clinical reports, society proceedings, books for review, and correspondence should be sent to the Editor, Dr. Carel C. Koch.

Annual Subscription, $3.00 in Advance, Canada and Foreign, $4.00.
Single Copies, 40c.

Copy of advertisements must be sent in by the tenth of the month preceding their appearance. Subscriptions, applications for single copies, communications with reference to advertising or other business should be addressed to the Business Manager, Dr. Jack I. Kurtz, 1501 Foshay Tower, Minneapolis, Minn.

Published Monthly by the
American Journal of Optometry Publishing Association.

The Journal has no objection to the reprinting by other magazines of any of its articles, provided such reprints are properly credited to the American Journal of Optometry.

SOME EARLY LENSES

Fincham[1] reports a paper by Beck,[2] who writing on Early Magnifying Glasses says that a well established center for the manufacture of glass is now known to have been working in Egypt as early as the fourteenth century B. C., the author quotes an interesting reference to the lens in the comedy of the Clouds by Aristophanes, performed in 434 B. C. in the second act of which Socrates and Strepsiades speak of the use of a glass lens as a burning glass.

In the Lavigerie Museum at Carthage is a set of six magnifying glasses of assorted sizes together with three crystal lenses all of which date from the sixth century B. C.

Two magnifying glasses are to be found in the Egyptian Department of the British Museum, one of which was found at Tanis, and definitely dates from A. D. 150. These lenses are about 2½ inches diameter and 3½ inches focus and have worked surfaces, the flat surface showing that it has been ground with a rotary motion against another flat, while the regularity of the curved surface suggests that it was ground by the usual method in a concave tool.

[1] Fincham, W. H. A. A Note on Some Early Lenses. The Optician. Vol LXXV, No. 1947, p. 400.
[2] Beck, H. C. Early Magnifying Glasses. Antiquaries Journal. Vol VII, No. 3.

A most important discovery in the early history of the lens was the finding in Crête last year of two crystal lenses which date back as early as 1200 B. C. and probably to 1600 B. C. The larger of these has a diameter of eight-tenths of an inch and a focus of one inch.

Beck suggests that the scarcity of lenses of this period which have been found may be due to a number having been made of glass which has corroded away as very few glass objects have been found, and expresses the hope that in view of the probability of the use of the magnifier on the minute work discovered at Ur, and the fact that crystal was then used further discoveries will enable us to place definitely the manufacture of lenses earlier even than those very important ones recently found in Crête.

* * * * *

JUVENILE DELINQUENCY AND REFRACTIVE ERRORS

Needles and Heather, of the Northern Illinois College of Optometry, reporting before the American Academy of Optometry at Chicago last December,[1] the results of an extensive ocular-visual survey made by them during 1932 on the juvenile inmates of the Chicago Parental School, found, among other things, that 93% of these delinquent children showed a refractive error in some correctible degree. As an average group of youngsters would show but from 50% to 60% of correctible refractive errors, their survey therefore substantiates the frequently suggested and more or less obvious, but heretofore as yet unproven statement, that apparently refractive errors have a definite bearing upon behavior. Here is a large group of children, all problem cases of a more or less serious character, showing in nearly every case the need for optometric service, yet in most cases this service or need had previously been ignored.

Just how many of these children would now be leading different lives had their refractive errors been corrected earlier in life is of course impossible to predict, but it is safe to say that the percentage is large enough to make it very worth while to see to it that all underprivileged children are given the proper refractive attention at an early age in some Free Optometric Clinic. C. C. K.

* * * * *

ON THE CAUSES OF UNIOCULAR ZONULAR CATARACT

Law[2] reviews twenty-two cases of uniocular (monocular) zonular cataract in which he finds a very high percentage of cases in which there

[1] Needles, W. B. and Heather, W. J. Vol. VII. The American Academy of Optometry. pp. 157-171. 1933.

[2] Law, F. W. Uniocular Zonular Cataract. British Journal of Ophthalmology. Vol. 16, No. 7, p. 385. 1932.

was a history of a non-penetrating injury sustained at an early age. A study of these cases leads him to the following conclusions:

1. The cause of a uniocular zonular cataract is trauma, almost invariably of the non-penetrating variety.

2. The injury is of a kind to cause a tendency towards dislocation of the lens.

3. The cause of the zonules or lamellæ of opacity is a temporary disturbance of the nutrition of the lens, brought about most probably by a severance of physiologic connection between lens and capsule, with a consequent alteration in the capsular permeability.

4. Such a type of cataract is most likely to occur in a young, actively growing lens than in an adult lens.

5. While it might be suggested that inflammation is an alternative cause of zonular opacity, the immediate cause being presumably a chemical or toxic action by the nutrient fluids, such a suggestion found no support in his investigation.

Law's conclusions are at some variance with the generally accepted views held by specialists regarding the cause of zonular or lamellar cataract, which appears, as its name implies, in the form of an opaque layer surrounding the clear center of the lens. This type of cataract, either double or single, has usually been considered congenital in its origin and is usually found to be stationary. Vision in these cases can, as a rule, be helped by the use of minus lenses. C. C. K.

* * * * *

THE SIZE OF THE OCULAR IMAGE IN ANISOMETROPIC CASES

In cass of anisometropia, the difference in the size of the two corrected retinal images is frequently a disturbing factor to the patient. Various suggestions have been made from time to time in the attempt to overcome this visual disturbance, the last being that of Rodgers[1] in the January-February issue of the Genothalmic Forum for 1933. Using the work of Ames, Glidden, Madigan, Ogle and Carleton[2] of the Dartmouth Medical School as a basis for his report, Rogers suggests that, in the Dartmouth investigation, it was found that to increase the base curve of a lens, it is possible to increase the ocular image size. This is known as "size lens." A "size lens" then is one that will alter the ocular image size without altering the compound refractive condition of an eye.

Now assuming a case of hyperopic anisometropia, we know that the ocular image of the eye with the strongest correction is larger than the image from the other eye because of the added plus. Now we also know that to render fusion easily, we must increase the ocular image of

[1] Rodgers, J. D. The Marysville Clinic. Marysville, Kansas.
[2] Annals of the Distinguished Service Foundation of Optometry. Little Building. Boston, Mass. 1932.

the eye with the weak correction or decrease the image size of the eye with the strong correction, and possibly both. Applying the Dartmouth information with the available lens grinding facilities and examining equipment at our command, we use a wide angle corrected lens for the eye with the weak correction and increase that ocular image size. We apply a flat lens for the eye with the strong correction and decrease the ocular image size. In myopia, the reverse is applied. A wide angle lens is used for the eye with the strong correction and a flat lens for the eye with the weak correction. C. C. K.

* * * * *

PHYSIOLOGICAL EXOPHORIA

Eames made a nearpoint and distance phoria test on some three hundred unselected school children and as a result of his findings comes to the conclusion that the accepted optometric belief regarding 6△ of physiological exophoria at the nearpoint is in error, at least in children. His findings did not show anything like an average of this amount, as he found an orthophoric condition for both distance and near in a large number of his cases. He concludes that exophoria increases gradually as the amplitude of accommodation decreases, and that any estimate of the amount of physiological exophoria must take into account the age of the patient.[1]

However, Eames did not make an entire refraction nor did he correct these cases and therefore the results of his tests cannot be accepted as being wholely reliable. The laboratory experience of many investigators and the clinical experience of hundreds of optometrists largely refutes his findings. He does, however, present in this way, an interesting point for further study and one which should be investigated at once.

C. C. K.

[1] Eames, T. H. Physiologic Exophoria and Age. Archives of Ophthalmology. January, 1933. p. 104.

ANNOTATIONS
AND
SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

ASSOCIATE STATE EDITORS

DR. E. B. ALEXANDER
Duncan, Okla.
DR. A. S. ANDERSON
Minot, N. D.
DR. J. F. ANDREAE
Baltimore, Md.
DR. O. E. BELL
Fairmont, W. Va.
DR. R. G. COLBERG
Aberdeen, S. D.
DR. C. H. DEGRAFF
Monroe, Mich.
DR. L. P. FOLSOM
South Royalton, Vt.
DR. F. W. FREEMAN
Anderson, Ind.
DR. A. J. LARGE
Winona, Minn.
DR. J. J. LIVINGSTON
Little Rock, Ark.
DR. M. B. MEYER
Wilmington, Del.
DR. J. K. MORRIS
Erie, Penn.
DR. C. A. PERRIGO
Norfolk, Neb.
DR. D. E. PLAISTED
Lewiston, Me.
DR. H. R. SPITLER
Eaton, Ohio
DR. A. P. WHEELOCK
Des Moines, Ia.

AMERICAN ACADEMY OF OPTOMETRY

In accordance with the terms of a resolution approved at the 1932 meeting of the American Academy of Optometry, a limited number of Fellowships for Research are now offered by the Executive Council of that organization.

These Fellowships are intended primarily to stimulate interest and productive work in optometry, physiological optics, and their underlying sciences.

To be eligible for appointment to an American Academy of Optometry Fellowship, the applicant must:

1. Hold a baccalaureate degree in arts or science from an accredited college or university;
2. Be a graduate in optometry from an accredited institution and eligible to practice in at least one State;
3. Have been actually enrolled for at least one year as a graduate student in the graduate school of a fully accredited university;
4. Have as his major subject physiological optics or one of the following underlying sciences: Anatomy, physiology, physiological chemistry, pathology, psychology, or physics.

American Academy of Optometry Fellowships for Research are usually awarded for one year but may be continued at the discretion of the Director of Research. The stipend is not fixed but varies according to the amount of time given to the research work of the Fellow. It averages $200 to $300 yearly, plus an additional allowance to cover the expense of equipment and the Fellow's appearance at the yearly meeting of the Academy.

All applications for Research Fellowships must be eligible to become members of the American Academy of Optometry and if not already members, become such when their applications for Research Fellowships are approved.

Further information may be obtained from the Director of Research, Edwin Forbes Tait, Ph.D., Pennsylvania State College of Optometry, Twelfth Street and Spencer Avenue, Philadelphia, Pa.

Requirements for the Preparation of Papers for Presentation at the Annual Meetings of the American Academy of Optometry

Reports and papers presented before the American Academy of Optometry should fall into one of the six following classes:

A. Experimental reports
B. Clinical Statistics
C. Individual case reports
D. Presentations of New Techniques or Instruments
E. Systematic Discussions
F. Economic or Political Subjects

Following are suggestions as to the preparation of each type of presentation:

A. Experimental Reports

An experimental attack upon any given problem should be preceded by a thorough review of the literature and a thorough understanding of all previous work on the given problem. The report should be presented in eight steps in accordance with the following outline:

(1) State fully the subject of the report and the extent and limitations of the problem.

(2) Present and discuss all of the previous work and summarize the conclusions to which previous investigators have come.

(3) Show clearly the necessity for further investigation in the subject.

(4) Determine the exact method to be pursued in the investigation and present it in minute detail, describing fully all instruments or apparatus used, all instructions given to the subject, and any other factors which have any bearing whatever upon the results.

(5) Present a statement of the results exactly as obtained, both in detail and summarized. The following graphic methods may be utilized:
   (a) Distribution charts
   (b) Curves on graph paper
   (c) Block polygons
   (d) Block curves

(6) If the results include two variables it is usually necessary to correlate these in some manner, either mathematically or graphically. The accepted methods of presenting the results graphically and correlating them may be found in "Statistics in Psychology and Education," H. E. Garrett, 1926.

(7) Discuss thoroughly the relationship between the results obtained

and those noted by previous investigators. Weigh carefully the apparent relative values of both.

(8) State any justifiable conclusions briefly but definitely. Conclusions should only be positive if the results of the investigation show beyond question the validity of the conclusions. It is important in scientific work to be conservative and avoid all over-statement.

Throughout the whole report care should be taken to give full credit to those responsible for previous work. If the ideas or statements of others are used, the source should be clearly indicated. Reference in the text may be indicated by numbers corresponding to footnotes. The footnote should give the full reference in the following order:

If a book—Name of author, name of book, volume, publisher, place of publication, date of publication, and page.

If a paper—Name of author, name of journal, volume, number, year, and page.

B. Clinical Statistics

In presenting clinical observations the same method should be used as in the experimental reports, making an effort to control any possible variable factors.

Be sure to have a logical systematic viewpoint to which the clinical findings may be related. Do not fail to investigate fully any previous work in the same field. Do not attempt to formulate definite theories unless full acquainted with the previous work and in possession of apparently conclusive evidence. Results which are presented without theoretical conclusions are just as valuable scientifically as those which are made the basis of such conclusions. Simple statistics are sorely needed, in order to show the general areas of distribution which are ordinarily encountered in the various ocular functions. For instance, a study of the incidence of exophoria or esophoria for distance, or of hyperphoria for near or distance, would form the basis of a very helpful and significant paper. There are a great many other fit subjects for such statistical presentations in the usual refraction determinations. The method of obtaining the data and the instruments used should be minutely described and the results, if possible, set forth both in tabular and graphical form.

C. Individual Case Reports

Exceptional cases encountered in clinical practice which seem to form some departure from the usually accepted normal may be reported in detail. Such presentations are of very considerable importance in showing the range of possible values which may be encountered in practice and if the sequelae of the case are known the report may be of great value to those who encounter similar cases.

D. Presentations of New Techniques or Instruments

In presenting new techniques it is important to have the same very definite background as is required in the experimental reports. There must be a good excuse for the development of a technique and a clear

understanding of what it is expected to accomplish. The most important factor in the presentation of either a technique or a new instrument designed to make a technique effective, is a record of the results when the method is used on a series of subjects or patients. A method which has not been subjected to adequate clinical trial should not be reported.

E. Systematic Discussions

Such discussions are valuable only when they have a thorough going basis of experimental and clinical evidence. Speculative viewpoints have no place in science except that of suggesting material for investigation and they must never be used as a basis for any applied system. Therefore, systematic papers are desired only when their scientific background is thoroughly acceptable and when such background is set forth in proper form in the footnotes and bibliography.

F. Economic or Political Subjects

Papers on these subjects can be presented only at the request of the Chairman of the Academy or the program chairman.

Discussions

In order that intelligent discussions may follow the presentation of original papers it is necessary to appoint some member or members of the Academy to lead the discussion on each paper. An effort will be made to have the original papers in the hands of those appointed to discuss them at least one month before the time of the meeting so that written discussions may be prepared.

In most cases those appointed to discuss the papers will be selected from among those members who have evinced an interest in the particular subject. As far as possible the same methods should be used in preparing the discussion of the paper as is used in the preparation of the original papers for presentation.

* * * * *

WASHINGTON AND OPTOMETRY

General Johnson, speaking before a group of chain-store retailers in Washington, D. C., on Friday, June 23rd, emphasized the fact that the government was particularly anxious to organize all persons having to do with the manufacturing and distribution of all commodities.

The new government act, according to General Johnson, gives permission to various elements of our distributing systems to so organize as to control trade practices both in the manufacturing and retailing fields, and specifically gives retailers the permission to get-together for the purpose of eliminating certain injurious practices which tend to reduce profits.

In this the government is not interested in increasing the profits to any particular group but insists *per see* that profits be increased over present levels so that additional men can be employed and so that wages

can be increased, thereby increasing also the general level of purchasing power of all communities. In this connection the Sherman Anti-Trust laws have been set aside for a two year period and the various practices heretofore prohibited by these laws are now to be encouraged.

Now, let us see just how this applies to the Optical Industry and the optometric profession. While both of these allied groups have been in the past relatively free from some of the abusive practices so prevalent in certain industries, nevertheless prices have been forced down in some communities by cut-rate inferior work on the part of a few irresponsible wholesalers and optometrists to a point whereby other capable and reputable wholesalers and practitioners were in a measure at least forced to meet this competition. Under this new act the reputable wholesalers through their associations will be able to face the outlaw cut price men to either get in line with them or get out of business, as all of these firms will be licensed and made to do business up to a standard and not down to a price.

In a personal talk with General Johnson following his address I found that he was uncertain whether or not the retailer (and in this connection an optometrist dispensing his own material would be a retailer) would immediately be licensed but the manufacturer and wholesalers will be through their association, and the present baneful trade practices will be eliminated as the penalties are very severe.

Washington more nearly resembles the war-time Washington of 1917-1919 than ever before. The newspapers print only the material which is handed out by the officials and the army seems definitely in the saddle, empowered to bring back prosperity, even at the cost of sacrificing some of the personal rights heretofore regarded sacred. A national emergency had arisen and the new administration has taken this means of combating it.

As far as our position as optometrists is concerned, it behooves us all to actively participate in our association affairs, as it is through the associations that the act will be administered. It is still too early to predict just what action will be taken by the A. O. A. in this matter but that organization representing the combined forces of all optometrists will no doubt become the spokesman for the profession and will, by cooperating with other societies in the allied fields, dominate the situation.

C. C. K.

HEDRICH-BLESSING STUDIO